NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

IRRIGATION WATER MANAGEMENT (ACRE)

CODE 449

DEFINITION

Irrigation water management (IWM) is the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned, efficient manner.

PURPOSE

Irrigation water management is applied as part of a conservation management system to support one or more of the following:

- Manage soil moisture to promote desired crop response.
- Optimize use of available water supplies.
- Minimize irrigation induced soil erosion.
- Decrease non-point source pollution of surface and groundwater resources.
- Manage salts in the crop root zone.
- Manage air, soil, or plant micro-climate.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable to all irrigated lands.

An irrigation system adapted for site conditions (soil, slope, crop grown, climate, water quantity and quality, etc.) must be available and capable of applying water to meet the intended purpose(s).

CRITERIA

General Criteria Applicable to All Purposes

All **irrigation and related water management** work shall comply with federal, state, and local laws and regulations. Water shall not be applied in excess of the needs to meet the intended purpose.

Additional Criteria to Manage Soil Moisture to Promote Desired Crop Response

The following principles shall be applied for various crop growth stages:

- The volume of water needed for each irrigation shall be based on plant available water holding capacity of the soil for the crop rooting depth, management allowed soil water depletion, irrigation efficiency, and water table contribution.
- The irrigation frequency shall be based on the volume of irrigation water needed and/or available, the rate of crop evapo-transpiration, and effective precipitation. **Frequency of application will vary throughout the year based on the growth stage of the crop, precipitation, temperature, humidity, wind, and other weather factors.**
- The application rate shall be based on the volume of water to be applied, the frequency of irrigation applications, soil infiltration and permeability characteristics, and the capacity of the irrigation system. **System capacity shall be based on the irrigation system's expected application efficiency, adjusted for local wind effects, site conditions (including applicable leaching requirements), and operator's management capabilities.**

NRCS, MT
April 2002

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard contact the Natural Resources Conservation Service.

NOTE: This type of font **(AaBbCcDdEe 123..)** indicates NRCS National Standards.
This type of font (AaBbCcDdEe 123..) indicates Montana Supplement.

Additional Criteria to Optimize Use of Water Supplies

Early maturing crops should be chosen when snowmelt runoff potential indicates low stream flow forecasts. Some watersheds in Montana frequently experience a reduction in mid- to late-season surface water supplies. IWM plans shall include management guidance when such conditions are likely. Limited irrigation water supplies shall be managed to meet critical crop growth stages.

Irrigation system design capacity as a minimum shall be planned to meet peak consumptive use for those years where water supplies are available throughout the entire growing season.

In those parts of the state where rainfall may contribute effective amounts during all or part of the season, systems shall be managed to supplement the rainfall events. (Supplemental water is the amount of irrigation water applied in addition to effective rainfall to meet the crop growth requirements and maintains the available soil moisture above minimum Management Allowed Depletion.) Management at this level will require day by day observation or accounting of the crop water use, and subtraction of that amount from the measured available soil moisture.

Water management under limited water conditions will require knowledge of the soil moisture availability for the crop growth stages and the expected average consumptive use during the growth stage. Additional control of the application system's capacity may be needed to adjust for the limited water supply. Soil moisture accounting may be determined through feel and appearance, tensiometers, resistance blocks and meters, or by other methods. Daily crop consumptive use can be collected from Weather Bureau observation data used with software products that calculate evapo-transpiration (ET) or Consumptive Use (CU). Local Bureau of Reclamation Agri-Met sites are available for use as well.

Additional Criteria to Minimize Irrigation Induced Soil Erosion

Application rates shall be consistent with local field conditions for long term productivity of the soil. **NRCS state approved water erosion assessment methods (RUSLE, FUSED, Imhoff Cones, etc.,) shall be used to ensure erosion rates are minimized during individual applications and held to sustainable levels.**

Additional Criteria to Decrease Non-Point Source Pollution of Surface and Groundwater Resources

Water application shall be at rates that minimize transport of sediment, nutrients, and chemicals to surface waters and that minimize transport of nutrients and chemicals to groundwater.

Additional Criteria to Manage Salts in the Crop Root Zone

The irrigation application volume shall be increased by the amount required to maintain an appropriate salt balance in the soil profile.

The requirement shall be based on the leaching procedure contained in the National Engineering Handbook (NEH) Part 623, Chapter 2.

Mid- and late-season stream flows from localized rainfall may be laden with greater salt content than early season snow melt runoff that are used for irrigation. Application system design shall provide capacity for leaching capability as needed. Water application rate and volume adjustments for salinity management shall be a part of the IWM plan as applicable.

Additional Criteria to Manage Air, Soil, or Plant Micro-Climate

The irrigation system shall have the capacity to apply the required rate of water for cold or heat protection as determined by the methodology contained in NEH Part 623, Chapter 2.

CONSIDERATIONS

The following items should be considered when planning irrigation water management:

- **Long-term evaluation of economic costs for construction and energy usage should be made during planning when comparing alternatives.**
- Consideration should be given to managing precipitation effectiveness, crop residues, and reducing system losses.
- Modify plant populations, crop and variety selection, and irrigated acres to match available or anticipated water supplies, water quality, or system application rate limitations.
- Consider potential for spray drift and odors when applying agricultural and municipal wastewaters.

- Equipment modifications and/or soil amendments such as polyacrylamides and mulches should be considered as needed to decrease erosion.

- Consider the quality of water and the **waters** potential impact to crop quality, **productivity,** and plant development.

- Quality of irrigation water should be considered relative to its potential effect on the soil's physical and chemical properties, such as soil crusting, pH, permeability, salinity, and structure.

- Avoid traffic on wet soils to minimize soil compaction. **Deep ripping of soils that are likely to develop hard pan layers should be considered.**

- Consider the effects that irrigation water, **conveyance losses, and return flows have** on wetlands, water related wildlife habitats, riparian areas, cultural resources, recreation opportunities, **and downstream water users.**

- **Improved** management of nutrients and pesticides **should be considered.**

- Schedule salt leaching events to coincide with **periods of** low residual soil nutrients and pesticides and **when higher water quality is available.**

- Water should be managed in such a manner as to not drift or come in direct contact with surrounding electrical lines, supplies, devices, controls, or components that would cause shorts in the same or the creation of an electrical safety hazard to humans or animals.

- Consideration should be given to electrical load control/interruptible power schedules, repair and maintenance downtime, and harvest downtime.

- Consider improving the irrigation system to increase distribution uniformity of irrigation water application. **Using closer set patterns or the replacement of sprinkler heads with wind fighting packages is helpful for sprinklers used in areas of high wind.**

- **IWM plans should consider extended periods of high winds and management techniques of the selected system to meet net crop requirements and available soil moisture levels for the crops growth stage.**

- **Season long periods of management should be considered for sprinkler systems installed where capacity is less than the daily net water requirements of potential crops to be grown under the sprinkler.**

PLANS AND SPECIFICATIONS

Application of this standard may include job sheets or similar documents that specify the applicable requirements, system operations, **irrigation scheduling, monitoring, record keeping, and other** components necessary for applying and maintaining the practice to achieve its intended purpose(s).

Irrigation Water Management (IWM) plans shall be site specific. The plan shall meet the Irrigation Water Management Plan Requirements in the Montana Irrigation Manual and in the state supplement to Chapter Nine of the National Irrigation Guide, NEH, Part 652.

OPERATION AND MAINTENANCE

There are no operation and maintenance (O&M) aspects applicable to this standard. Necessary O&M items are addressed in the physical component standards considered companions to this standard **or the IWM plan.**

REFERENCES

The following references may provide useful guidance and information in the development and application of irrigation water management principles:

National Engineer Handbook, Part 652, Irrigation Guide.

National Engineering Handbooks, Part 623, Section 15, Chapters 1–7 and 12.

National Engineering Handbooks, Part 634, Section 15, Chapters 8 and 11.

Water Measurement Manual, U.S. Department of the Interior–Bureau of Reclamation.

Montana NRCS Irrigation Guide and Manual.

Montana NRCS Supplement to the Engineering Field Handbook (NEH, Part 650).